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Sewing, &c.—S. Pitt (com.), 1562. W. Scott and D. S. Morrison, 1627. J. McHardy, 1828. C. Pieper (com.), 1880. W. R. Lake (com.), 1890. J. Heggan, 1897. V. Milward, 1900.

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⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

COVERED SERVICE RESERVOIRS.

By William Morris, M. Inst. C.E.

At a meeting of the Institution of Civil Engineers, on the 20th of February, Mr. Brunlees, President, in the chair, the following Paper on the above subject was read:—

The author alluded to the fact that covered reservoirs were used by the Romans, and other ancient people, for keeping water cool and pure for potable purposes, and showed that their use was by no means a recent refinement, although they had only lately been introduced in modern waterworks. It did not appear, from official returns, that covered reservoirs were used in London in 1840, when filtration had only been partially introduced. But it soon became evident that covered reservoirs were necessary for the storage of filtered water, and accordingly it was enacted by the Metropolis Water Act, 1852, which required all water (except water pumped from wells) to be filtered, that all reservoirs for filtered water within 5 miles of St. Paul's Cathedral should be covered. This enactment was more particularly intended to preserve the water from contact with the smoke of London; but the objection to uncovered reservoirs was by no means confined to the neighbourhood of large towns, as owing to the rapid growth of vegetable and animal life in service-reservoirs, the improvement from the filtration of the water was rapidly lost, especially during the summer. As examples, the author referred to the uncovered reservoirs constructed at the cost of the Admiralty in Greenwich Park and on Woolwich Common, for the protection, in case of fire, of the Greenwich Hospital, Royal Dockyard, and other Government establishments, which were partially used by the Kent Waterworks for the supply of their district. The author then proceeded to describe the covered reservoirs at Plumstead and at Shooter's Hill, purchased by the Kent Company. These were covered by brick arches, springing from cast-iron girders. Then followed descriptions of different works, including the Chislehurst Reservoir, which was built of brick, covered with arches supported by cast-iron girders, and rendered internally with cement. The circular reservoir, purchased from the Dartford Local Board of Health, was covered with brick arches supported on nine wrought-iron joists radiating from the centre, where they were supported by a cast-iron column. The circular reservoir in Greenwich Park consisted of brick arches, resting on concentric rings of rolled wrought-iron, girders supported by piers. The filter-beds at Deptford were converted into covered reservoirs, consequent on the Kent Company abandoning the supply from the river Ravensbourne in favour of spring-water from the chalk, in which case the old filtering material was utilised in the construction of the concrete vaulting. The covering of a small reservoir at Plumstead with Bunnett's flooring was described, and the construction of a covered reservoir on Woolwich Common in lieu of the old one referred to, when relinquished by Government. This was an oblong reservoir 200 feet long by 100 feet wide; the walls were of concrete, faced with brick; the covering arches were of brick springing from rolled joists supported on brick piers. The above works were designed by the author's father, the late Mr. W. R. Morris, M. Inst. C.E.

The author then described the New Cross Reservoir, built under his direction in 1874, which was similar to that on Woolwich Common, except that the roof consisted of brick arches springing from the piers instead of rolled joists. He then gave a full description of a reservoir recently constructed by him at Farnborough, Kent, in which the outer walls were reduced to a minimum, by supporting the covering arches till their springing was level with the centre from which they were struck. This system was adopted for the end as well as for the side walls. An account was given of a slip which occurred during the construction of the reservoir, and of the means taken for making the work secure.

The East London Waterworks Company had at Hornsey Wood a fine brick reservoir which was capable of containing 5,000,000 gallons of water. The same Company had at Haggar Lane a reservoir capable of containing 1,500,000 gallons. This also was built of brick: the vaulting was supported by longitudinal walls, stiffened by transverse walls, so that the reservoir was divided into forty-nine sections, the walls of which were pierced with circular openings. The Kilburn Reservoir, capable of containing 6,000,000 gallons, was a fine brick structure, with vaulted roof, supported on cruciform piers; the outer walls were supported by buttresses against the pressure of the external earth. The Hampton Reservoir, capable of containing 2,750,000 gallons, was constructed entirely of concrete. This reservoir was built in clean sharp gravel, and the excavated ballast was admirably adapted for the concrete. The arches sprung from wrought-iron joists. The Burton-on-Trent Reservoir, built for the South Staffordshire Waterworks, had a capacity of 4,000,000 gallons; it was rectangular on plan, and was covered with brick arches springing from cast-iron girders, supported on cast-iron columns; the walls were of concrete, faced with Staffordshire bricks.

The author then referred to several service-reservoirs, of which he had the opportunity of learning some particulars during a recent tour, The Charlottenburg Reservoir of the Berlin Waterworks, with a capacity of 5,000,000 gallons, was built of brick, with walls sufficiently thick to resist the internal pressure of the water; the soil was fine loose sand, on which bitumenised paper was spread before laying down the concrete foundations. The Berlin filter-beds were covered with Bohemian vaulting, the foundation of which rested on gravel puddle. The reservoir at Breslau, capable of containing 900,000 gallons, was supported on a tower 130 feet high, and the tower contained the pumping-engines. The author then described one of the Vienna reservoirs, and furnished some notes on the aqueduct which supplied that city. The waterworks of the city of Munich, which were in course of construction at the time of his visit, comprised a reservoir having a capacity of 8,800,000 gallons; the walls and floor were of concrete, the vaulting was semicircular, built with one ring of brick. The author gave a sketch of the Frankfort Reservoir and some notes as to the water supply of the city. The reservoir and works of the Darmstadt Waterworks were noticed; the reservoir was of brick, built above ground; it was capable of containing 900,000 gallons; the water was pumped from six tube-wells, sunk in the sandy plain between the Odenwald mountains and the Rhine at Griesheim, about 5 miles from the city. The reservoir at Cologne, which consisted of a cast-iron tank, with a capacity of 800,000 gallons, was erected on a tower 100 feet high; the water supplied to the city was pumped from wells on the banks of the Rhine; but the spring-water was quite distinct from the Rhine water. The Dresden Reservoir was capable of holding 4,600,000 gallons of water. The Hanover Reservoir, with a capacity of 2,400,000 gallons, was of brick. It stood 30 feet above the ground-line, and the outside walls supported the full pressure of the water without the assistance of any embankment.

After some remarks on the marked preference of Germans for spring-water as compared with lake-water or river-water, the author concluded the paper with a sketch of his idea of a model service-reservoir. This was so arranged that the earth dug from the excavation was all utilised in forming the necessary embankment. The floor and the side-walls were of concrete, the piers, arches, and valting of brick, The vaulting was similar to that of the Farnborough Reservoir; but the ends of the vault were brought down with a curve of 12 feet 6 inches radius till they rested on correspondingly curved bays in the concrete end walls. By this construction the thrust of the roof would be carried down to an abutment reaching against undisturbed ground, and the pressure of the water on the reservoir would not only be supported by the abutment, but be also counter-balanced by the weight of made-earth facing the embankment, which rested on the exterior arches of the reservoir, in addition to the pressure of the earth which would have to resist internal pressure if the walls were vertical. The author held that the whole of the interior surface should be rendered in cement mortar.

CONCRETE CONSTRUCTION.

Concrete of one kind or other appears to have been used from time immemorial, the Romans having so perfected the art as to give rise to the name of Roman cement, although cement proper was not known to them; nevertheless by a skilful combination of Pozollana and other refuse, along with burnt crockery, and lime, they succeeded in producing work which has been the admiration of the civilized world. Little was known of what we now understand as cement concrete until the year 1818, when some French Architects, after about eight years of experiment and enquiry, made known the results. Concrete for house-building purposes seems to have been first used in England by Mr. Ranger, of Brighton, who obtained a patent for the formation of concrete slabs or bricks, composed of lime, &c.; treated in a specially defined manner. This process, however, proved too costly, and very little progress was made for some years. Nevertheless the Houses of Parliament were built upon concrete foundations, and in 1837 Mr. Godwin was awarded the first medal of the Royal Institute of British Architects for an essay on concrete.

Roman cement came into use for concrete at Harwich in 1841; cottages were built of this material, although no person can long have confidence in it. Later on an experiment was made at the Isle of Wight to build in Medina cement, but this differs little from Roman. It is as recent as 1852 that Portland cement cottages were first built in the Isle of Thanet, and in the same year a patent was obtained for the construction of concrete sewers.

In consequence of the solidity of concrete it still continued to be used for foundations. Cement mixed in an unskilled manner, was often employed for facing brick walls, &c. It was soon found to be a complete waste of both time and material to use lime and cement mixed.

There are now many uses to which cement concrete can be economically and wisely applied with perfect confidence in its success. Perhaps one of the most successful applications of concrete is the construction of a fire-proof floor and ceiling combined. There have been formed concrete arches of 14 feet span, and any length of bay, and these were found upon loading the upper surface with three hundredweight per foot, not to have suffered the slightest declension observable. For practical purposes, however, the commoner spans of 10 feet are much more desirable.

The floors of the Government Barrack at Ashton, Derby, and Bury, are constructed upon concrete arches after a similar fashion.

Another system which is commonly adopted—as circumstances seem to require—is that known as "flat" fire-proofing, as distinguished from "arched" fire-proofing; in each case the upper surface may be finished with cement or asphalt flooring, or with wood or tiles. The flat fire-proofing is formed with main girders, fixed at say 10 feet from each other, then smaller girders are laid at the top or bottom flanges, and these small girders are embedded in the concrete—the weight and number, of course, being determined by the span and load to be carried.

Concrete engine beds probably give more satisfactory results than any purpose to which this material has been applied. It is generally conceded that concrete engine beds are equal to stone in all and superior in most respects; being in one solid mass it forms a much safer and steadier foundation than any other material: the largest engine beds can be finished in one or two weeks, where time is important, and the cost is about half that of stone.

The value of concrete for street and cart road paving, for basements, yards, kitchens, and such places as need a damp-proof material, is well known, and need not be enlarged upon.

The advantages of concrete for grain-house floors, also for many kinds of warehouses, are pretty obvious; while for stables, it is probable that no other material would be used, if it were always skilfully laid down. The cleanliness and freedom from vermin, in consequence of the hermetically-sealed paving, cannot perhaps be overrated. For bleach-works, dye-houses, and breweries, where slush, wet, and dirt are common nuisances, the employment of this material is highly appreciated; and because of the ease with which obnoxious and other matter can be removed therefrom by shovels or other means, these clean, smooth, though not slippery, floors will probably be brought into far more general use than at present.

Tanks of all kinds can be formed of concrete, from the handsome garden fountain, to the mill, reservoir, or sanitary receptacle.

It is only necessary to name these as a slight indication of the wide range of usefulness open to this material; but a most important and valuable application has also been made of it to the construction of breakwaters, docks, piers, and other marine works.

Then there are the numerous articles which can be *cast*, such as artificial stone, window and door heads, sills, spingers, string courses, cornices, mantelpieces, tiles, &c., but we believe that the proper finish for many of these purposes cannot yet be obtained at a price which will command general adoption.

Many attempts at concrete house-building have been made, but hitherto these have been attended with but partial success.

The first idea of slab or block building in cement concrete was too costly to be popular, as were also the alternative systems of "cellular" building, or pipes filled with concrete, and another one forming a core of concrete lined with thin bricks or tiles.

Mr. Tall (Patent dated 1865) applied himself to a complete system of "monolithic" concrete building, by forming a kind of wooden "box" round the entire building to be erected, and when this "box" had been filled, the sides were taken off, much like so many wooden shutters, and moved higher, on fixed wooden standards; taper cores of wood formed a shell for the bolts, which passed through the wall and connected the sides of the box or frame. A similar system was adopted in forming flues.

In 1868 a system was patented on a similar principle, but adopting channel iron uprights, instead of the wood and iron frames or shutters of Tall. The sides of the frame were secured by flat iron straps, and could be moved up the iron standards as the work progressed. The flues were formed by a sheet-iron collapsing flue core, and iron brackets secured on the uprights by bolts were substituted for those of wood as described; in fact it was iron *versus* wood.

The drawbacks attending these systems seems to be the cost of the apparatus, the difficulty and cost of carriage, and the little facility given for ornamentation as the work progressed, leaving all sills, courses, and cornices to be entirely formed by the plasterer.

Another system was patented in 1874, and consists in the formation of concrete structures with such timber as would be used in the same building, *i.e.*, the flooring boards, joists, &c., and the substitution of a few light girders, uprights, or standards, upon which the framing, composed of such boards, is moved upwards as the work progresses.

Whether in the future the building of dwelling-houses will be carried on with the aid of concrete or not, we shall not venture to predict, but content ourselves with stating that many practical objections have to be overcome, before any very general application for this purpose is made. Nevertheless, the many uses, such as we have pointed out, to which this material can be advantageously put, must force themselves upon public attention more and more, as the superiority is demonstrated, and, in our opinion, only need, in many cases, to be mentioned to ensure adoption.

W. G.

PHYSICAL EXERCISE.

A lecture under the auspices of the Edinburgh Health Society was lately delivered by Dr. Charles Cathcart, Lecturer on Anatomy in the Edinburgh School of Medicine, on "Physical Exercises; their Place and Function." Dr. Cathcart, after defining physical exercise as the "action and use of our bones and muscles," went on to explain the anatomy of the muscles, the manner of their attachment to the bones, and their great capacity of contraction—it being stated that the body was arranged into about 400 separate muscles of various sizes and shapes. No muscle could contract unless stimulated by a nervous impulse coming from the brain or spinal cord. Each muscle had its own particular action, but no muscle ever contracted by itself. They could thus see that the exercise of one part of the body indirectly told upon many others which they did not suspect. Hence the value of vigorous walking, for instance, with the swing of the arms, the balance of the body, and the action of the legs; but hence, also, the danger of movements which were one-sided and often repeated, producing the constant and associated action of certain groups of muscles, which might bring about changes in the bones and alterations in form which no one would suspect.

Going on to consider the effect of muscular exercise on the various functions of the body, Dr. Cathcart first noted the changes it caused in the respiration. They were all familiar with the fact that exercise not only made the heart beat quicker, but caused them to breathe more rapidly and freely and at the same time the amounts of carbonic acid and watery vapour exhaled were much increased. Under ordinary circumstances it had been found that a man drew in 480 cubic inches of air per minute; if he walked four miles an hour he drew in 2,400 cubic inches, and if six miles an hour, 3,360 cubic inches. The muscles, in contraction, used more oxygen and gave out more carbonic acid, consequently a greater demand was made on the lungs. More air was required, and the blood must be driven the faster through them; and that accounted for the shortness of breath and beating of the heart which accompanied any muscular action.

If they looked at the demands made upon the air while a person was taking exercise, they would see how very important it was that the air should be not only large in amount, but also exceedingly pure in quality. Let them take, as an example, an ordinary dancing party. There were more people in the room than it was intended for; the whole company exerted themselves violently —certainly as much as would be equal to walking four miles an hour—and what was the consequence? Not only did they now require five times as much air as they did before, but they were using up the oxygen, and giving out the carbonic acid at a relatively much increased proportion—while people were afraid to open the windows in case of draughts. When they remembered that that was almost always carried on in a blaze of gas light, every burner of which used as much air as four or five men, they could see that those entertainments required serious attention and careful management if they were to be conducted on sound principles of health.

Emphasizing the point that during exercise the lungs should have the freest possible play, the lecturer said he had been furnished from good authority with an illustration of the effects of custom *versus* humanity and sense in the late Egytian war. A body of soldiers and another of marines had to make a march of three miles under the burning sun. The soldiers had their tight-fitting jackets, the marines their loose and free costume. Before the march was ended 130 of the soldiers had fallen out, while every man of the sailors continued in his place. He knew of no other difference between the two sets of men but the costume.

The effects of physical exercise on the circulation and on the nervous system were next in turn considered. As to the first, as any unwonted strain must act injuriously on the heart, necessity existed for beginning gradually and systematically any exercise which involved unusual exertion. On the latter point, the reasonableness of relaxation and rest to the brain was insisted on, and muscular exertion commended as one of the best cures of mental overwork. That brain and muscle could be developed at the same time was illustrated by a reference to the oarsmen of Oxford and Cambridge; and the intelligence of the working classes was also cited as a proof that hard and constant physical labour in no way tended to depreciate the quality and strength of brain power.

As to the effects of exercise in expanding the chest some striking facts were given, not the least interesting of which related to a school where physical exercise had been systematically carried out. The effect of regular exercise was shown as follows: New boys, age 14, average chest measurement, 29·3; at 15, 30·6; at 16, 32·0; at 17, 32·6; and at 18, 32·5; while former boys measured respectively 30·6, 32·1, 34·2, 35·8, and 36·8.

In conclusion Dr. Cathcart laid down some rules for regulation of physical exercise; 1. It should be conducted in an abundance of fresh air, and in costumes allowing free play to the lungs, and of a material which will absorb the moisture, and which, therefore, should be afterward changed—flannel. 2. There should always be a pleasant variety in the exercise, and an active mental stimulus to give interest at the same time. 3. The exercises should as far as possible involve all parts of the body and both sides equally. 4. When severe in character, the exercises should be begun gradually and pursued systematically, leaving off at first as soon as fatigue is felt. 5. For young people the times of physical and mental work should alternate, and for the former the best part of the day should be selected. 6. Active exertion should be neither immediately before nor immediately after a full meal.

GORDON'S FIRE ALARM.

An important step in advance in the construction of electrical fire alarms has recently been effected by Mr. W. C. Gordon, the manager of the Langham Hotel, London, the working of which has just been inspected by us. The recent disasters from fire in American hotels has naturally led to a misgiving on the part of the public with regard to hotels generally. The knowledge of this led Mr. Gordon to set about effecting an arrangement by which the firemen, who are on duty day and night in the hotel could be instantly summoned to any floor of the building on which an outbreak of fire might occur. It should be premised that there are ten floors at the Langham, and on every floor there are ample means of extinguishing a fire. There are stands of fire-extinction appliances, fire-buckets, and hand-pumps, always filled and ready for work, whilst rising mains run from bottom to top of the building and are always kept charged with water at a high pressure. On every floor is a hydrant, with hose and branch pipe on the stand close by ready for attachment, all these fittings having been designed and supplied by Messrs. Merryweather and Sons years ago. In fact, the Langham has always been most perfect as regards its fire arrangements, the only thing wanting having been the means of instantly summoning the firemen to the precise locality of the outbreak of fire, no matter where it occurred or in what part of the building the men might be at the moment. This has now been satisfactorily accomplished by Mr. Gordon's arrangement, which is simple in arrangement and certain in action. The apparatus consists of four main parts, namely, the ordinary push or circuit closer, the battery, the bell, and the indicator, which are, however, connected up by a special device. On each of the ten floors are pushes and indicators, whilst bells are placed in different parts of the hotel, so that they can be heard at any and every point. The indicating tableau has as many signalling apertures, each provided with a signal disc, as there are floors in the hotel. On a fire taking place the visitors or servants at once make use of the push, which instantly sets all the bells ringing, the locality of the fire being at the same time made manifest by every indicator in the building. Thus, no matter where the firemen may happen to be at the moment, they can be collected at the scene of the outbreak in an incredibly short time, usually from 35 to 40 seconds. Arrived on the spot, they have a splendid equipment of fire appliances to deal with, and can make very short work with a conflagration at an early stage. It may here be observed that it would be almost impossible for a serious fire to occur at the Langham, the structure being wholly built of brick and stone, and in a most solid manner, no lath and plaster whatever having been used. On recently inspecting this invention, an alarm of fire was given on the third floor, and in forty seconds two of the firemen were on the spot, a third following a few seconds later.

Having given a general idea of Mr. Gordon's invention, and its application in practice, we will now proceed to explain its details. There are as many electrical circuits as there are signalling apertures in each indicator, the circuits corresponding respectively to the different floors of the building, and each circuit passes respectively through the operating electro magnet of the signal disc in every indicator which is appropriated to denote the particular floor to which the circuit corresponds, and all these circuits are connected in multiple arc with the main leads from the poles of the battery. Each circuit between, say, the first indicator and its junction with the main lead is carried to any convenient point of the floor which the signal discs upon it are appropriated to denote, and at this point it is broken and provided with the push piece, whereby the circuit may be closed through all the indicators, and the signal disc denoting that floor brought into view at its aperture in each indicator. In the circuit of the main lead between the last indicator of the series and, say, the negative pole of the battery are interposed a number of electric bells arranged in multiple arc. In very large buildings, when it is desired to ring bells at opposite extremities of the building, Mr. Gordon uses two batteries and two sets of electric bells, in which case he connects the positive poles of the batteries by a wire, and connects the one main lead to it, and branches the main lead from the negative poles at a point between the last indicator and the two sets of bells, so that the current will divide and pass through both sets of bells in returning to the negative poles of the two batteries. To enable all the signal discs which have been actuated to be returned to their normal position, by closing a circuit at any one of the indicators, each indicator is provided with a set of reversing magnets, one for each signal disc, all these magnets being arranged in series and connected at one end with the negative pole of the battery, whilst a wire from the other end is branched to a push piece or circuit closer upon each indicator, a wire connected to the positive pole of the battery being similarly branched to the push pieces, so that on the circuit being closed at any one of them a current will be passed through the whole series of reversing magnets of all the indicators, and will thus return any of the signal discs, which may have been previously thrown over, to their normal position. The signal discs are carried by polarised needles, pivoted so as to oscillate between the pairs of actuating and reversing electro magnets. We thus have, as we have said, a very ingenious system of signalling, applied in a useful and practical, manner, and which is, moreover, well adapted for use in hotels and other large buildings. We may add that Mr. Gordon's invention was carried into effect at the Langham by Mr. Koeber, of 43, Frith Street, Soho, the result giving every satisfaction.

Fireproof Paint.—The following process, invented by Messrs. Vildé and Schambeck, is described in *La Papeterie*. The paint consists of 20 parts of finely pulverized glass, 20 parts of finely pulverized porcelain, 20 parts of any sort of stones in powder, 10 parts of calcined lime, and 30 parts of water-glass (silicate of soda), such as usually found in commerce. The solid elements having been powdered as finely as possible and sifted, are moistened, and then intimately mixed with the water-glass. This yields a mass of sirupy consistence, that may be employed for painting, either alone or mixed with colour. The addition of the lime gives a certain unctuosity to the mass for white-washing, and its combination with the silicic acid of the soluble glass serves to bind the other materials together. Instead of the silicate of soda (soluble glass of soda) soluble glass of potash might be used; but the former is less expensive. The coating is applied with a brush, as other paints are, as uniformly as possible over the surface to be protected. The first coat hardens immediately, and a second one may be applied six hours or more afterward. Two coats are sufficient. This paint may likewise be employed as a preservative against rust, and used as a coating for iron bridges, &c.

The Scientific Review

AND

SCIENTIFIC AND LITERARY REVIEW,

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THE INVENTOR'S INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE. LONDON.

ESTABLISHED 1ST MAY, 1862.

President: HIS GRACE THE DUKE OF MANCHESTER.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P. SIR ANTONIO BRADY, till his decease, 1881.

SESSION 1882—1883.

May 10th. A Paper on "Valves, Cocks, and Taps, with special reference to Recent Improvements."

If time permit the Patent Bill will be considered.

May 24th., at 4 o'clock p.m., Annual General Meeting.

T. MORGAN, Sec. *pro tem.*

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

Proceedings of the Institute.

A Special Meeting was called April 4, owing to the lamented decease of the Secretary (F. W. CAMPIN), and a resolution passed expressing condolence with Mrs. CAMPIN. It was agreed a deputation attend the funeral.

Mr. T. MORGAN was appointed Secretary of the Inventors' Institute *pro tem.*

April 26th.—Executive Council met, and usual routine business transacted. It was resolved that a petition to Parliament be prepared and brought up at next meeting for consideration relative to the Government Patent Bill.

Monthly Notices.

We hear, says *The Athenæum*, that the Committee of the Reform Club have arranged for a part of the club being experimentally lighted with the electric light. The incandescent lamps are to be tested in the principal rooms of the club. The manufacturers of the Elphinstone-Vincent dynamo machine are to have the opportunity of carrying out this experiment, which cannot but prove interesting to all the larger clubs.

Under the title of "The Book of Health," Messrs. Cassell and Co. will issue next month a volume upon the science of the preservation of health in every relation and condition of life. The work is edited by Mr. Malcolm Morris, and the following authorities contribute articles to the work: Mr. W. S. Savory, F.R.S.; Sir Risdon Bennett, F.R.S.; Dr. T. Lauder Brunton, F.R.S.; Dr. J. Crichton Brown; Mr. J. Cantlie, F.R.C.S.; Mr. F. Treves, F.R.C.S.; Dr. J. E. Pollock; Dr. J. Russell Reynolds, F.R.S.; Mr. Shirley Murphy, M.R.C.S.; Dr. W. B. Cheadle; Dr. C. Dukes; Mr. Henry Power, F.R C.S.; Mr. G. P. Field, M.R.C.S.; Dr. J. S. Bristowe, F.R.S.; Mr. C. S. Tomes, F.R.S.; Sir Joseph Fayrer, K.C.S.I., F.R.S.; Dr. Joseph Ewart; and Dr. Hermann Weber.

The "British Fisheries Directory" is the title of a work which is nearly ready for publication by Messrs. Sampson Low and Co. In view of the growing interest in the development of the fisheries of this country, and the attention which will be drawn to the subject by the forthcoming great International Fisheries Exhibition, this work should prove useful. It will embrace all kinds of fishing and everything relating to fisheries.

Physiological Effects of Coffee.—From a series of experiments J. A. Fort concludes that coffee acts by exciting the cerebro-spinal nervous system. In strong doses it produces sleeplessness, cramp, pains in the stomach, and disturbed action of the heart. It neither increases nor lessens the consumption of nitrogenous matter in the system.

Volatile Constituents of Coal.—On the evening of Thursday, April 26th, an interesting and important paper was read at the Society of Arts, on "A New Process for the Separation and Recovery of the Volatile Constituents of Coal," by Mr. T. B. Lightfoot, M. Inst. C.E., the chair being occupied by Sir Henry Hussey Vivian, Bart., M.P., F.G.S. The author, after pointing out the necessity that exists for some simple and economical method for recovering volatile products now almost universally lost in the coking of coal, and showing that in the pig-iron manufacture alone the money value of this waste amounts to about 5s. 6d. per ton of iron produced, proceeded to describe the process just recently invented and brought into use by Mr. J. Jameson, of Newcastle-on-Tyne. Though recovery ovens have been before coke-makers for some time, they had not met with any great degree of favour in this country, chiefly owing to the expense attending their adoption, existing plant being entirely inapplicable; but in Jameson's process only a slight and inexpensive alteration is required, and it could therefore be at once applied to the whole of the present owens, which are estimated to have a capacity of dealing with 20,000,000 tons of coal a year. If this were done the value of oil and ammonia so obtained would at existing prices be worth some £3,250,000, while a large amount of good heating gas, which taken at the extremely low price of 3d. per 1000 cubic feet, would come to £2,500,000, would also be made available. The author then drew attention to the applications of the recovered products, which, instead of blackening and defacing the surface of the country and destroying vegetation as at present, would give us solid paraffin and valuable illuminating and lubricating oils, for which we are now greatly dependent on the apparently failing supply of spring oil in America. Ammonia, also, which is much wanted for agricultural operations, as well as for many industrial purposes, would be produced in large quantities; indeed, it has been estimated from the experiments of Sir J. B. Lawes that if the ammonia from all the raw coal now burnt in this country was utilised in agriculture, we should add £50,000,000 worth of breadstuffs to our produce. With regard to the gas left after condensation of the volatile constituents, it was stated that it might be most beneficially used in gas-engines for the production of mechanical work, or electricity might be generated and conveyed for conversion into light and power.

THE SCIENTIFIC REVIEW
AND
Scientific and Literary Review
INCORPORATING THE "JOURNAL OF THE INVENTORS' INSTITUTE."

MAY, 1883.

F. W. CAMPIN, Esq.

We referred briefly in our last to the lamented decease of the Secretary of the Inventors' Institute. It may be of interest to our readers to learn a few particulars of his life, seeing how closely he devoted his energies during the whole of his lifetime to inventors and their cause, and to securing due recognition of their claims, which a few years back were considered of no value at all.

The reverse of this feeling is to a great extent due to the exertions of himself and those with whom he was associated, and which endeavours have gained for Inventors that recognition which is but their right.

From about the year 1840 he was engaged in Patent business in offices of well-known standing. In 1845 he became a correspondent of the *Mining Journal*, his almost weekly communications on Patent Law Reform for seven years succeeding that date being generally recognised as exhaustive and to the point. To a great degree we are inclined to believe these letters, coupled with his personal attention in conjunction with others with whom he was allied, led to the passing of the Patent Law Amendment Act of 1852.

The passing of this Act was a great stride, but it was not, in his opinion, sufficient, and to the day of his death he devoted his time and attention to aid in procuring improvements therein in the interest of Inventors.

During the period of the agitation for the reform of the Patent Laws he was practising as a Patent Agent, and continued so for some years.

On the establishment of the Inventors' Institute in 1862 he was one of the first members elected, and was also elected Member of the Council, acting in the latter capacity in cordial co-operation with Mr. R. Marsden Latham, the then Secretary. Upon the death of Mr. Latham in 1873, he succeeded him as Secretary, which post he occupied till his decease.

In 1864 he was called to the Bar by the Honourable Society of Gray's Inn, and as Standing Counsel to the Inventors' Patentright Association, Limited, he was ever ready to give advice and legal assistance, which we are convinced was much appreciated by both Inventors and clients.

As an author and authority on Patent Law we refer our readers to his work in Weale's Series.

He was a Member of the Society of Arts since 1846, and a Fellow of the Royal Society of Literature.

Mr. Campin at the time of his decease was in his sixtieth year.

INVENTORS' INSTITUTE PETITION.

Whereas,—It has been fully and publicly recognised by a Minister of the Crown that Inventors are the creators of trade, and that they should be encouraged and not repressed.

The humble petition, &c., of the Inventors' Institute,

That the Patent Office may be an independent department administered by three persons, a Controller and two assistants, all of judicial training, and that these may have power to try and decide all cases arising under the Patented Inventions, Copyright, Trades Marks, and Designs Act, with or without assessors.

That the subject-matter of a Patent may be more defined, the wording of the Statute of Monopolies having long given rise to doubt and difficulty, and that the definition be, as nearly as may be, in the words originally settled by the International Congress of Paris, 1878, and embodied in the Bill of the Society of Arts.

That the only change in the existing Provisional Protection, other than as to duration, be by the insertion of the words, "shall describe in outline the nature of the invention," and that no claims be in any case required to be made, nor any other than explanatory drawings, where such are absolutely indispensable, on the filing of the Provisional Specification.

That there be an advisory examination, of an interlocutory character, but only of the complete specification, by the examiner of the special subject involved, before any report is made to the Controller, but that no endorsement of the Patent shall in any case be affixed to the Patent if granted.

That it should be distinctly stated in the Bill—(*a*) That all the parts of an invention may be comprised under one Patent, and (*b*) that any number of claims may be entered for those parts, whether in combination or separately.

That no attempt should be made to bring the Complete Specification into exact accordance with the provisional document, which should be kept secret and destroyed, on the filing of the complete specification or on notice of abandonment by the inventor.

That no plea of an infringer shall be admitted other than a denial of the infringement complained of.

That no documentary or other evidence shall be received in a suit for revocation, unless it proves—

(*a*) Publication within thirty years last past from sources independent of the Patent Specification.

(*b*) Public user within thirty years last past.

That the procedure of all parties aggrieved by the issue of a Patent shall be by a suit in order to obtain revocation of the Patent, during which all infringement must be suspended, since rights granted by the Crown should be respected until proved to have been granted in error and therefore revoked, and any person may oppose the original grant on good and sufficient grounds.

That the object of the Bill be clearly stated to be a considerable reduction of the fees and their limitation to a single payment, so soon as this course may commend itself, by receipts sufficient to pay all expenses of the Patent Office, seeing that large revenues must accrue to the State from other sources if trade is created by patented inventions, and it would therefore be financially unwise to burden this creative industry in its inception, beyond what is absolutely necessary for the due regulation thereof.

That the duration of a patent should be twenty-one years, and that it should have precisely the same effect against the Crown as against a subject, provided always that the patentee shall refer any claims for royalty or otherwise against the crown to a fair arbitration.

That no compulsory licenses be ordered, since these would destroy the trade it was sought to create in its infancy, after large expenditure, to prove it valuable, and discourage the investment of capital even in the most promising inventions, whereby great results might otherwise have accrued to the State.

SONNET

IN MEMORY OF

FREDERICK WILLIAM CAMPIN, F.R.S.L.

O FRIEND to those who needed oft a friend,
Who, ever ready with thy mind and heart,
To give the knowledge thou couldst oft impart;
Who loved, with arts and sciences, to blend
Inventive genius, and support that end,
To thee my song shall be. Thy life was part
Of that which lives to raise the truest art:
As greater thoughts to higher deeds ascend!

Thy one desire was the reward of worth
To merit for invention fully given;
If such the labour of thy love on earth,
So much the nobler still thy life in heaven!
There, now, united with thy friend[*] once here,
To work thy future in another sphere.

HENRY GEORGE HELLON.

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[*] Sir Antonio Brady.

Proceedings of Societies.

ROYAL SOCIETY.

APRIL 19.—The President in the chair.—The following papers were read: "Measurements of the Wave-lengths of Lines of High Refrangibility in the Spectra of Elementary Substances," by Prof. Hartley and Mr. E. Adeney,—"The Limiting Thickness of Liquid Films," by Profs. Reinold and Rücker,—"On the Total Solar Eclipse of May 17th, 1882," by Capt. Abney and Dr. Schuster,—and "Note on *Syringammina*, a New Type of Arenaceous Rhizopoda," by Mr. H. B. Brady.

BRITISH ARCHÆOLOGIAL ASSOCIATION.

AHRIL 18.—Mr. T. Morgan in the chair.—Mr. L. Brock exhibited a small oil painting, a portrait of Mary Tudor, the second sister of Henry VIII., the young and beautiful wife of the aged Charles XII. of France, to whom she was married in 1514, and afterwards to Charles Brandon, Duke of Suffolk. The queen is represented in a red dress and is holding a golden cup.—Dr. Woodhouse exhibited a small black ware bowl of Roman date, recently found at Putney, where it had been used in Roman times for sepulchral purposes. It contained the burnt bones of a child when found, notwithstanding its small size.—Mr. W. G. Smith described a fine bronze celt recently found in Ireland.—Mr. A. Chasemore produced a proof from the old trade plate used at the Old Chelsea Bunhouse occupied by Mr. Chapman. It has a representation of the building as it then appeared, different from some of the published engravings.—Mr. W. Myers produced a diversified series of antiquities brought principally from the East, there being many fine examples of flint arrowheads, Roman keys, &c. A flint hatchet of the earliest known period was remarkable from having been worked into form by the agency of fire.—The Rev. S. M. Mayhew described a series of articles found principally in London during recent excavations. A cocoa-nut bowl was shown, found at the Minories, in the gravel, at a great distance from the surface. A Roman spear-head, with the cutting edge formed like an inverted ρ, and a finely-worked Roman key were also shown. Following the recent exhibition of the small Hebrew *shofar* or hand trumpet, a drawing was produced of the best known form of the *lituus*. This was made by Mr. Myers from the original in the Etruscan collection in the Vatican.—A paper was read "On Saul, near Downpatrick, with Special Reference to St. Patrick," by Dr. D. Lithgow. After glancing at the condition of the country at the period of St. Patrick's landing in 432, he described the features of the district, and pointed out that the river Slane, now almost entirely silted up, was the route followed by the Saint, and that Saul, St. Patrick's Barn, was the site of his first church in Ireland.

ZOOLOGICAL SOCIETY.

APRIL 17.—Prof. W. H. Flower, President, in the chair.—The Secretary read a report on the additions made to the Society's menagerie during March, and called special attention to three sirens (*Siren lacertina*) from South Carolina, presented by Dr. G. E. Manigault, and to an American teetee monkey of the genus *Callithrix*.—Papers and letters were read: by Prof. Flower, on the systematic classification of the mammalia which he had recently prepared for use in arranging the specimens in the museum of the College of Surgeons, and in a treatise on the subject of mammals in the "Encyclopædia Britannica,"—from Mr. W. L. Distant, the first of a series of contributions to an intended monograph on the homopterous family Cicadidæ: in the present paper the author gave the results of an examination of the Cicadidæ contained in the Dresden Museum (including the specimens collected in the Celebes by Dr. A. B. Meyer), and added the descriptions of other species belonging to the collections of Dr. Signoret and the author; eleven species were described as new from various localities,—by Mr. Sclator, a second paper on the birds collected in the Timor Laut or Tenimber group of islands by Mr. H. O. Forbes, based on additional specimens lately received; the avifauna of the group, as indicated by Mr. Forbes's collection, contained fifty-nine specimens, of which twenty-two were peculiar to these islands,—and from Mr. F. Moore, the first part of a monograph on the butterflies belonging to the groups *Limnaina* and *Euplœina*.

ENTOMOLOGICAL SOCIETY.

APRIL 4.—Mr. J. W. Dunning, President, in the chair.—The death of Prof. P. C. Zeller, of Stettin, one of the honorary members of the Society, was announced and commented upon.—Two new Members were elected.—Mr. W. F. Kirby exhibited specimens of *Acridium succinctum*, Linn., one of the most destructive species of migratory locusts in India.—Prof. Westwood mentioned that a myriopod, *Polydesmus complanatus*, Linn., had lately been erroneously announced to be the cause of the potato disease.—The Rev. A. E. Eaton exhibited a patent revolving object-holder used by mineralogists, which seemed likely to be useful to entomologists also.—Mr. E. A. Fitch exhibited galls of *Cecidomyia violæ*, Loew, and of *Aploneura lentisci*, Licht.—Mr. H. Goss exhibited specimens of *Pimelia angulata*, Fabr., from the Temple of the Sphinx at Ghizeh.—The following papers were read: "On the Classification of the Germ-feeding Races of Fig-insects," by Sir S. S. Saunders,—"On a small Collection of Clavicorn Coleoptera from North Borneo," by Mr. A. S. Olliff,—"Descriptions of New Genera and Species of Hymenoptera," by Mr. P. Cameron,—and "Notes on New or Little Known Species of Hymenoptera, chiefly from New Zealand," by Mr. W. F. Kirby.

CHEMICAL SOCIETY.

APRIL 19.—Dr. W. H. Perkin, President, in the chair.—Messrs. T. L. Briggs, J. A. Barker, J. B. Coleman, W. H. Cannon, E. C. Conrad, G. Gillett, E. C. Henning, N. K. Humphreys, L. Levy, A. Ness, V. I. Schopoff, and A. E. Wilson were elected Fellows.—The following papers were read:—"On the Gases evolved during the Conversion of Grass into Hay," by Messrs. P. F. Frankland and F. Jordan. The authors find that comparatively dry grass soon evolves considerable quantities of carbonic anhydride, with mere traces of hyprogen and hydrocarbons. This evolution of gas occurs in air and in an atmosphere of carbonic anhydride or hydrogen. In oxygen a notable proportion of nitrogen accompanies the carbonic anhydride. Under water grass also evolves carbonic anhydride with some hydrogen due probably to lactic fermentation, acetic, lactic, and propionic acids being simultaneously formed.—"Notes on an Apparatus for Fractional Distillation under Reduced Pressures," by Mr. L. T. Thorne.—"Notes on the Condition in which Carbon exists in Steel," by Sir F. A. Abel and Mr. W. H. Deering.—"On the Spectrum of Beryllium, with Observations relative to the Position of that Metal among the Elements," by Mr. W. N. Hartley.

THE DESIGN AND CONSTRUCTION OF REPAIRING-SLIPWAYS FOR SHIPS.

By T. B. LIGHTFOOT, M. Inst. C.E., and JOHN THOMPSON.

THE following paper was read at a meeting of the Institute of Civil Engineers.

After reference to the first introduction of cradles on rollers by the late Mr. Morton, of Leith, in the year 1819, a description was given of a modern slipway, capable of dealing with vessels of about 2,500 tons gross weight, and up to 300 feet in length. Four sections were dealt with in detail, viz., the foundations, the ways, the cradle, and the hauling machinery, and allusion was made to the gradient, which had generally to be determined by a consideration of the amount and value of land at disposal, by the depth of water to be provided over the cradle, and sometimes by the natural slope of the ground.

The foundations were described as not being difficult or expensive, except in special cases, as the weight of the vessel and cradle was spread over such a large area as to reduce the pressure per unit to a very small amount. Piling was objected to unless the whole length of the way was thus supported, as it was important to obtain uniformity of bearing throughout the entire length, in order to avoid excessive local stresses. The cast-iron rails upon which the cradle travelled were then referred to, and the method of laying and fixing them on the timber-ways was explained.

With regard to the submerged portion of the ways which usually had to be put in place with the assistance of divers, various proposals for shortening the slip, and so decreasing the expense of construction, were dealt with. These were, first, making the cradle telescopic, so that when run out the several divisions closed up, while as soon as hauling commenced they opened out to receive the vessel; and, secondly, enclosing the upper part of the slip within watertight walls, provided at the bottom with a pair of gates. Both these systems had been adopted by the Authors, but the latter was only applicable in cases where there was a sufficient rise and fall of tide. When diving had to be resorted to, the submerged portion of the ways was first of all framed together on land, and the rails laid. It was then floated out over its final position, and sunk by laying on a sufficient weight of stones, the ground having been previously prepared by dredging and levelling up with ballast.

The construction of the cradle was next mentioned. The timber used was generally American oak, put together in the form of three ribs, one at the centre and two at the sides, over the outer lines of rails. The ribs were braced together and mounted on strong cast-iron wheels with wrought-iron axles running in cast-iron carriages. Across the ribs were beams of wood or iron carrying sliding bilge-blocks worked from the vessel itself. Ploughs, stays, and pawl-gear were provided, as well as wrought-iron guides, for convenience in placing the vessel.

The hauling-up machinery was described as being now generally actuated by water-pressure, though in some cases engines with gearing were used, especially in slipways for small vessels.

The Authors then detailed the working of a slipway, mentioning the preparation and running down of the cradle, which sometimes are permitted to project 30 to 40 feet over the end of the ways, and the floating on of the vessel, which was guided by hawsers from the quay or jetty, and by the cradle-guides. After hauling-up had commenced, the ship gradually settled down on the keel-blocks, and the sliding bilge-pieces being run in, it was drawn out of the water seated on the cradle. In launching this process was reversed. Two instances were then given of methods by which more than one vessel could be taken on a single slipway at one time. The first was by means of hydraulic presses placed under the keel of the ship, which enabled the weight to be transferred from the cradle to blocks supported entirely on the ground, so that, by providing the cradle with swinging arms, it could be run down out of the way and prepared for receiving another vessel. In the second method (Thompson and Cooper's), two cradles travelled on distinct sets of rails, with slightly different inclinations, so that the vessel might be transferred from one to the other, according as the two cradles were simultaneously hauled up or lowered down.

Morton's hydraulic hauling-gear, in which the links had to be disconnected at the end of each upward stroke, in order to take out a length, and permit the ram to travel back and be reconnected, was then described; and after pointing out the serious loss of time occasioned by this operation, the Authors proceeded to show how, by improved gear, loss of time was avoided. With this apparatus there was no disconnecting of links, which merely travelled up and down the ways according as the rams were on their outward or inward, connection with the cradle being made by pawls attached thereto, which geared with the links on their upward stroke, and slipped so soon as they were reversed. During the short time the links were stationary in reversal at top and bottom, water was accumulated under pressure, and given out when the rams travelled in one direction or the other.

Reference was made to Messrrs. Hayward, Tyler, and Co.'s hauling gear, also to that introduced by Messrs. Day and Summers, the former being objected to on account of its cost, and the latter from the difficulty in obtaining wire ropes sufficiently durable to work under the heavy strains to which they would be subjected in a large slipway. Formulas were given for calculating the practical dimensions of the hauling gear, and the expense of working a slipway was stated, both for Morton's system and that of the Authors.

The average cost of construction of a slipway was very difficult to determine, but it was stated that a slipway to haul up vessels weighing 2,500 tons, with 850 feet of ways, hauling-machinery, links, and one timber side-jetty, would probably come to £25,000 without the land.

In conclusion, the Authors said they did not advocate the indiscriminate use of slipways, but the choice of their adoption or otherwise must be left to the engineer, after a survey of the ground, and a careful consideration of his resources. They thought, however, that in many situations the slipway possessed advantages in regard to first cost and facility in execution which should specially recommend it to the capitalist; while, from a shipowner's point of view, the better ventilation around the vessel when it was withdrawn from the water, the opportunity afforded for inspection, and the short time occupied in hauling-up and launching were very important features.

The Paper dealt with only such methods a were generally in use, and did not attempt to describe arrangements and modifications which might be desirable in special cases. Reference was, however, made to the combined floating-dock and slips as first carried out in 1851 at Philadelphia, the total cost of which was about £163,000.

LACK OF ENCOURAGEMENT TO INVENTORS.

If inventors were to rely solely upon the commendation of their friends or the public as an inspiration to labour, says an exchange, the source of which is unknown to us, there would be few great inventions. The world looks upon inventors as a visionary and unpractical class of people, who merit only condemnation and ridicule. Just before Singer completed the invention of his now famous sewing machine, even his fellow-workmen in the shop where his experimental machine was being constructed left him in disgust, thinking his invention a failure. When Westinghouse tried to introduce his air brake, he met with the most chilling rebuffs both in this country and in Europe, Edison, whose inventions are the marvel of the present century, has been the object of unstinted abuse and ridicule. Some of the greatest creations of his wonderful inventive mind were characterized as stupid failures until the demonstration of their successful operation overcame this hostile criticism. Even Thomas and Gilchrist, whose recent invention of the basic process of steel making is among the wonders of modern invetion in metallurgical science, have come in for their share of discouraging criticisms and rebuffs. Thus might we go through the whole list of inventors, from the earliest days to the present, and few would be found who have not experienced the unkind and unmerited opposition, not only of the general public, but in most instances of their own personal friends. The testimony of Fulton, Watt, Franklin, and a host of others renowned in the past for their wonderful discoveries would corroborate this statement and furnish forcible evidences of its truthfulness.

Inventors, as a class, are very sensitive to criticism. A part of the reward which they hope to obtain for their invention is a public recognition of its value. None but an inventor can tell how disheartening are the unkind and unsympathetic criticisms which he is forced to listen to; and these criticisms are harder to bear because in most instances they are as unjust as they are unkind, often displaying the ignorance and superficiality of the speaker. That inventors are sometimes unmanned by the ungenerous manner in which their inventions are received is not surprising. A gentleman in one of our Western towns, after years of study, has finally brought forth a very meritorious invention. During all these years he has met the studied opposition of his family and friends. His sons have even carried their opposition so far as to refuse to contribute a single dollar toward helping him introduce his invention, now that he has obtained a patent for it, and the result is that, wearied out by the discouragement which his family and friends have placed in his way, he has become prostrated. If, at last, the world shall come to prize his invention for what it is worth, and he shall derive—as he may—a fortune from it, these undutiful sons will, no doubt, be the first to claim a share in the wealth thus obtained.

The man who strives to perfect an invention, whether successful or not, is entitled to the commendation of his fellow-men. We have never sympathized with those who speak sneeringly of that much-despised class of inventors, those who have striven to solve the problem of perpetual motion. Mistaken and erratic as they may be, they are engaged in a line of duty which is, to say the least, honourable and elevating. Thousands of inventions there are to-day that the world calls valueless, which, were they placed in practical hands, would prove most useful and beneficial, and a source of wealth to the owners.

Inventions, as a general thing, are an innovation on present customs or modes, and are therefore a step in advance of present thought. A century since, had any one suggested that any one could stand in his own home and hold converse with a friend fifty miles away, he would be thought to be talking nonsense. Had any one at that time said that the mail would be carried from New York to Chicago in a day, he would have been considered equally as foolish. The prediction that messages could be sent on lightning's wing beneath the ocean from this continent to the Eastern continent would have been hailed with ridicule. These inventions were steps far in advance of the thought or knowledge of those days. It does not militate against the greatness of the discoveries that made all these things possible that the dull brain of the masses could not comprehend them until they were practically displayed to the world. The further he is in advance of the present thought or knowledge of the masses, the greater will be the opposition which the inventor will have to overcome before he will attain a just recognition of his labours.

A great inventor must be a man of independent thought, a man of nerve and courage, a man of hopefulness and determination. Many an inventor has been turned back, even when his feet were pressing the threshold of a great discovery, because he had not courage to stem the tide of opposition which he was encountering. Many a practical invention has been dropped before completion because of the inventor's discouragement and lack of push and determination. Twelve years ago a certain inventor filed in the Patent Office at Washington an application for a patent for the invention of a certain article. On some technical grounds the patent was disallowed. The inventor, in the meantime, had been discouraged by his friends, and so ceased pressing his claims. What, then, must be his surprise to find his invention now in quite general use, years after he had surrendered it to the public. The experience of this man is but a sample of the experience of thousands of others.

It is a surprising thought when contemplating what invention has done for the progress and civilization of the age, that inventors meet with such a tardy recognition of their works. The wonder is that they are not held in higher esteem. The world could afford to pension its Stephensons, [its Trevethicks, Ed. S. R.], its Morses, its Bessemers, its Edisons, and its Bells. It has erected statues to some of these, and it can afford to erect statues to all its noted discoverers. In olden times men of scientific attainments were held in high esteem. Why ought they not to be held in a like high estimation to-day?

We grant that the names we have given above are so held, but there are untold thousands of names of inventors of useful things, valuable and indispensable to the world, that should be placed in glowing letters on the scroll of fame. Our inventors need encouragement when they are alive, not after they are dead. Men do not work simply to gain a fitting epitaph. Their needs are in the present, and the earlier the world recognizes and applauds their work the better will it be for them and the inventive art.—*Scientific American.*

THE GAULARD-GIBBS SECONDARY GENERATOR.

THE Royal Aquarium, Westminster, in establishing an Electrical Exhibition strikingly indicates the rapid advance in popularity electricity is making among the public outside the scientific and financial worlds, and the important invention of Messrs. Gaulard and Gibbs which is exhibited there, and which we desire to notice more particularly, has assisted in no small measure to rouse the attention of all practical persons whether scientists or not, for its aim is the solution of the initial difficulty in the general application of electricity, viz., its distribution.

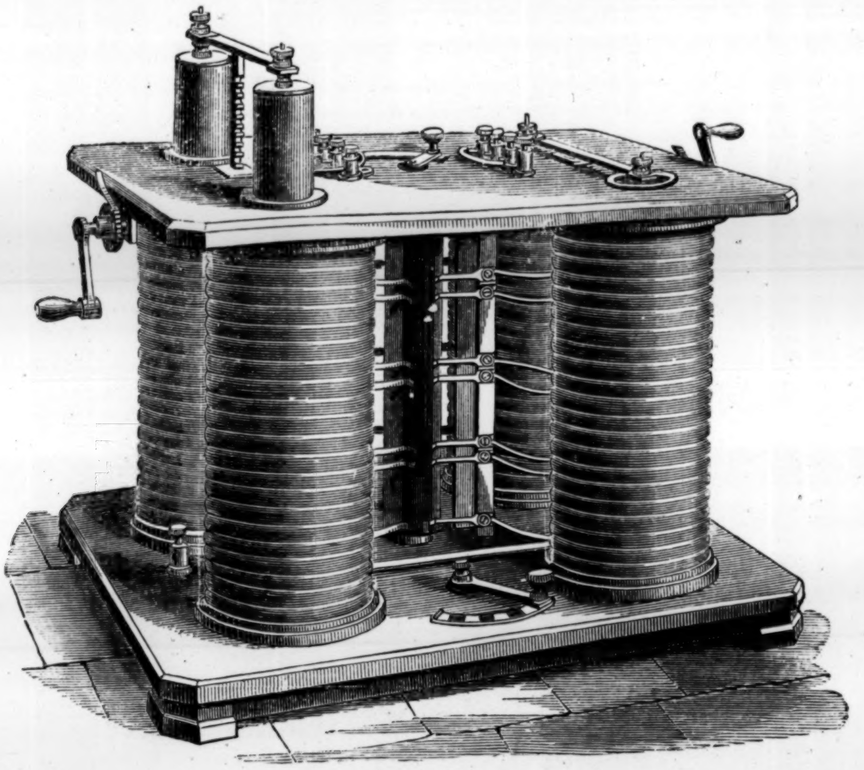
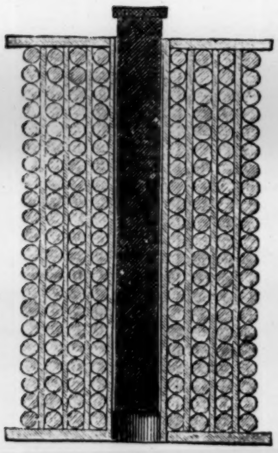
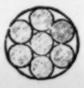


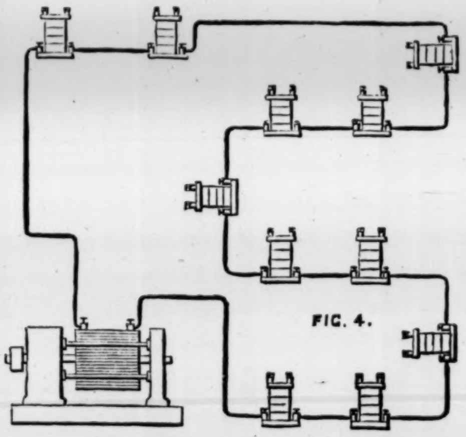
FIG. 1.



FIC 2.



FIC. 3.



FIC. 4.

In Court No. 12, at the Aquarium, Messrs. Gaulard and Gibbs are demonstrating every day, and with the most satisfactory results, the practical application of their theory, which is based upon the researches of Ampere.

The influence of currents in movement upon bobbins of insulated copper wire have in effect but little occupied the attention of savants since Faraday demonstrated the action of magnets on bobbins.

Starting with the theory that an alternating current of high tension will generate in a closed selenoid a secondary current without diminishing its own quantity, Messrs. Gaulard and Gibbs have constructed an apparatus which consists of one or more columns of primary and secondary coils of insulated wire, a column being formed by a cable (composed as follows), rolled round a hollow wooden cylinder:—Seventy-two insulated wires one millimetre in thickness are twisted into six cables, which are then wound round the central wire of three millimetres. Several of these columns may be fixed on the same stand, and the terminals being connected up separately, the secondary current generated on the finer wires by the movement of the alternating current through the central conductor may be utilised for arc and incandescent lights or motive power, together or separately.

The accompanying sketch shows a secondary generator of four columns, through the centres of which exciting cores of soft iron are raised or lowered by the movement of the small handles seen at the edge of the top part of the stand. The purpose of this arrangement is to regulate the quantity of current, which is increased or diminished proportionately with the lowering or raising of the core. This of itself is a great advantage, for the perfect control thus obtained over the quantity render possible the use of incandescent lamps of all resistances. The commutator seen on the bottom plate of the stand directs the generating current through one or more of the columns as may be necessary, or short circuits the apparatus when no current is required.

The two secondary generators we saw at work at the Aquarium were influenced by the same primary current which traversed also calculated carbon resistances, so that the generators were practically miles apart. One of the apparatus supplied Swan incandescent lamps, a Jablochkoff candle, and a small motor, each being under separate and perfect control, whilst the other secondary generator lighted 26 incandescent lamps.

Each apparatus was perfectly independent of the other, and was manipulated with the greatest ease, a simple turn of the handles mentioned being all that was necessary to produce the different currents or regulate their quantity.

The primary current retained throughout its primitive quantity, its tension only being lessened by the resistance in the circuit and secondary generators.

The primary circuit being closed, its electro-motive force may be increased according to the number of secondary generators placed upon it without being dangerous in the slightest degree, whilst the currents generated are absolutely harmless.

Another important point is, that the generating or primary current being one of small quantity requires only a small conductor, no matter how numerous the secondary generators may be. This current may consequently be produced under most economical conditions and transmitted a great distance; thus, natural forces (such as tides and waterfalls), which may be a number of miles distant, may be utilised, or coal may be turned to account at the pit's mouth, and the current thus produced sent along a wire of the size of an ordinary telegraph wire. In giving the name "secondary generator" to their apparatus, Messrs. Gaulard and Gibbs are justified, for it generates currents from bobbins influenced by a primary current, just as a dynamo machine generates currents from bobbins in movement before magnets.

The clumsy and mechanical turning of the magnet in the latter, with its attendant friction, vibration, and varying number of revolutions, is replaced by the alternating movement of the primary current, the accuracy and economy of which are fully proved by the regularity of the current generated, which, depending only on the quantity of the primary current, are independent of the variations in the primary generating machine.

We have no hesitation in saying that a great future awaits the new system, for it brings electricity as a domestic light within the reach of all, at a price which will enable it to compare favourably with gas; whilst as a distributor of motive power it has many advantages, such as cleanliness, noiselessness, facility of transfer, absolute control of pressure, and economy; and in solving the great problem of electrical distribution, Messrs. Gaulard and Gibbs have undoubtedly overcome the initial difficulty which has prevented, up to the present, the general adoption of electricity.

SIR JAMES DOUGLASS'S BURNERS.

One of the most interesting and important of the lighting exhibits included in the gas section at the Crystal Palace is undoubtedly that provided by the company which has acquired the patents granted to Sir James Douglass in respect of his remarkable burners, and at the present moment the advent of an invention of this character would appear to be of considerable consequence to almost every industry connected with the manufacture or supply of artificial light. For several years past the contest between gas and electricity, as a general means of illumination, has been watched with much interest, and the peculiar importance of Sir James Douglass's new burners lies in this—that while they materially assist gas, as opposed to electricity, they bring into prominence a no mean opponent of both, viz., mineral oil. We are, of course, aware that there are those who affect to believe that under no condition of circumstances can oil for a moment successfully compete with gas; but with such results as are indicated below as possible of attainment we leave it to our readers to form their own opinions as to whether the cause of the older illuminant is so altogether hopeless. Before proceeding to describe the invention it is, perhaps, as well that just a word should be said in regard to the inventor. Sir James Douglass, as all the world knows, is the engineer to the Trinity House Corporation, and, as the officer in charge of the numerous lighthouses and lightships which abound about our coasts, has, of course, given a very large amount of attention to the question of lighting. One of his principal objects has been to obtain the best possible light for lighthouse purposes, and the result of his varied researches and experiments has been the burners which are the subject of this notice, which are applicable in principle to almost every use to which gas is now applied in ordinary business and private establishments, so far as illumination is concerned, and which in practical operation prove no less economical than efficient, giving an amount of light per foot of gas consumed far in excess of that yielded by any Argand or flat-flame burner known. Inventors, as a rule, are too apt to claim for their offsprings impossible results, and it is, therefore, as well in the present instance to bear in mind the position of the discoverer and the objects which have prompted his inquiries.

To deal with the invention first as a gas burner. It is now generally conceded that for illuminating purposes the Argand, or cylindrical form of burner, is greatly superior to the flat flame. In the present exhibition at the Crystal Palace many Argand burners of great beauty and great power are shown, but judging by alleged results the Douglass burner seems to stand pre-eminent. The South Transept is devoted to an exhibition of these burners. The invention, like all great inventions, is simplicity itself, and appears to us to attain finality, as it were, in that direction. It may be briefly described as a mechanical contrivance in the form of a combination of concentric cones, or deflectors, which, by their simple but peculiar shape and convergence, induce intense air currents at the point of combustion, where almost perfect incandescence at once takes place, and the maximum amount of light can thereby be obtained from the gas consumed; and one very noticeable feature of the invention is, that it is applicable, at a very trifling cost, to existing Argands, whether large or small. This is a most important fact, as there are hundreds of thousands of Argands now in use, and it is stated by the exhibitors that the addition of Sir James's patented contrivance increases the illuminating power of even the best known Argands from fully 50 to 80 per cent on the same consumption of gas. For instance, an ordinary 2-ringed Argand, giving a light equal to about 2·50 candles per cubic foot of gas consumed (which is very nearly, if not quite, the highest service that is got from Argands under ordinary conditions), will, with the addition of the Douglass cones, give the increased light of 4·30 candles, or even more, which is a very startling statement, and, if correct, will undoubtedly place this invention in a pre-eminent position. The South Transept is lighted up by six large six-ringed Argand lamps and one ten-ringed lamp on the Douglass principle; and some idea of the power of these burners may be formed, when it is stated that the smaller size, consuming about 90 cubic feet of gas per hour, gives a light equal to 500 candles, or 5·55 candles per cubic foot of gas consumed, and we are informed that even higher results (6·60) have been obtained under different conditions. The ten-ringed burner, when only six of its rings are used, gives a light equal to 1317 candles, but when fully lighted, the magnificent result of over 1500 candles is, it is stated, obtained. It may here be mentioned that these lamps are so constructed as to work at one-third, one-half, two-thirds, or full power as required, so that users can have a great blaze of light or otherwise, as they may consider necessary. The Douglass burners, by means of their perfect combustion, give forth an intensely pure, white, soft light, which does not distress the eye; and it is a remarkable circumstance connected with the arrangement, that the glass chimney, which, from its liability to break, is a continual source of trouble and expense in the case of ordinary Argands, is here kept by the peculiar action of the air-currents at a safe temperature, the flame being kept steady and compact in the centre of the chimney, thus reducing the risk of breakage to a minimum. The Improved Gas and Oil Burner's Company, of 32, Palmerston Buildings, who have purchased the whole of Sir J. Douglass's patents, are directing their attention to the application of these burners to commercial, domestic, and other purposes. The company, at the special request of the Gas Exhibition Committee, have undertaken the illumination of the large clock, 40 feet in diameter, at the south end of the Palace. This is most successfully accomplished by the use of four 30 feet Douglass burners, of 150 candle-power each, in conjunction with four 21 inch parabolic reflectors, the united powers of which throws a conical beam of about 16,000 candle intensity. A more difficult area to illuminate effectually than the face of this clock—some 43 feet of diameter—could scarcely be imagined.

But, as already indicated, this burner is equally applicable to oil Argands as to gas, and has been adopted by the elder brethren of the Trinity House for their lighthouses and lightships. With oil, the results obtained are simply marvellous. It gives an increased illuminating power from 250 to 300 per cent above the best appliances formerly in use at an increased cost to the Trinity House of only 2½ to 3 per cent per annum. Our readers will doubtless be disposed to inquire as to the practical value of an oil burner of this character, designed for use in lighthouses, to ordinary householders. The reply is, that the burner can be, and has already been, made in several sizes, and exactly meets the requirements of both private and business establishments. Some evidence of the great value of these oil lamps for domestic or office use, and of the progress which they indicate, is afforded by the results of certain tests which have very lately been made. The company has just manufactured a small burner which, even in its partly developed state, when compared with one of the most successful oil lamps hitherto introduced to the public, shows the extraordinary nett superiority in standard of efficiency of over 200 per cent in favour of the Douglass lamp, both lamps being of the same dimensions, and their flame of the same sectional area. We have ourselves seen in operation one of Sir James Douglass's small burners constructed to yield a light of about 30 candles, and when the question of cost is considered, the importance of such an apparatus to ordinary householders can scarcely be over-estimated. It has always been urged as a great objection to oil lamps that they require great attention in trimming. In the case of this particular burner the trimming required is practically nil. It has been found, by a series of tests, that they will burn continuously for from nine to sixteen or eighteen hours according to size, and then show a diminution in the light of only about 2 per cent. When trimming is required, it is only necessary to pass the finger over the top of the burner, and a perfectly level wick is at once secured. When the light is required no longer, the supply of oil to the burner is stopped, and the top of the wick becoming charred, can easily be brushed off, the upper part of the wickholders being so constructed as to facilitate this operation. And now as to the question of cost. It has been ascertained that one gallon of oil used in these burners will yield the same amount of light as 450 cubic feet of gas. The price paid by the Trinity Corporation for its oil is, we believe, 9d. per gallon. Our readers will therefore have little difficulty in calculating for themselves the relative cost of oil and gas when these burners are available. In the United States, Germany, or Russia, where oil is cheap and gas dear, Sir James Douglass's patents must be simply invaluable. In many of the cities of the United States gas is at least two dollars per 1000 feet.

It may be a matter of some interest to notice the progress of lighthouse illumination in the case of the famous Eddystone, the new structure being the first to be provided with Sir James Douglass's improved system. In Smeaton's day the Eddystone was lighted by 24 candles, of six to the pound, arranged on a chandelier, without any reflector. Early in the present century they were superseded by 24 oil lamps, with reflectors. In 1845 the Argand lamps and reflectors were abolished in favour of Fresnel's new dioptric system, by which *one* large central central flame was employed, the rays from which were magnified and refracted. This apparatus, with a 4-inch lamp, remained in operation until the new Eddystone Lighthouse, when a new 6-wicked burner, of the last new patent of Sir James Douglass, was for the first time introduced, which gives a flame of 4½ inches diameter, and is equal to 722 standard sperm candles. The novelty of the development does not rest here, for *two* 6-wicked burners are fitted, one superposed on the other, the vertical distance between the two being about 6½ feet, so that, if the atmosphere is not clear, flashes of enormous intensity can be sent forth by use of these powerful lights, the combined illuminating power of which is said to be equivalent to a quarter of a million of candles, or about 6000 times the intensity of the original candlelight of Smeaton's time.

The foregoing particulars will, we think, be held to be fully sufficient to justify the remark with which we opened, as to the valuable and important nature of this invention of Sir James Douglass, whose whole life has been more or less devoted to the question of increasing the illuminating power of gas and oil in the lighthouses under his control. The results he has obtained are truly marvellous.

A NOTE ON SAP.

By PROFESSOR ATTFIELD, F.R.S.

THE following Paper was read at an Evening Meeting of the Pharmaceutical Society, April 4, 1883.

Beneath a white birch tree growing in my garden I noticed, recently, a very wet place on the gravel path, the water of which was obviously being fed by the cut extremity of a branch of the birch about an inch in diameter and some ten feet from the ground. I afterwards found that exactly fifteen days ago circumstances rendered necessary the removal of the portion of the branch which hung over the path, four or five feet being still left on the tree. The water or sap was dropping fast from the branch, at the rate of 16 large drops per minute, each drop twice or thrice the size of a "minim," and neither catkins nor leaves had yet expanded. I decided that some interest would attach to a determination both of the rate of flow of the fluid and of its chemical composition, especially at such a stage of the tree's life.

A bottle was at once suspended beneath the wound so as to catch the whole of the exuding sap. It caught nearly five fluid ounces between eight and nine o'clock. During the succeeding eleven hours of the night 44 fluid ounces were collected, an average of four ounces per hour. From 8.15 to 9.15 this morning, very nearly seven ounces were obtained. From 9.15 to 10.15, with bright sunshine, eight ounces. From 10.15 until 8.15 this evening the hourly record kept by my son Harvey shows that the amount during that time has slowly diminished from eight to a little below seven ounces per hour. Apparently the flow is faster in sunshine than in shade, and by day than by night.

It would seem, therefore, that this slender tree, with a stem which at the ground is only seven inches in diameter, having a height of 39 feet, and before it has any expanded leaves from whose united surfaces large amounts of water might evaporate, is able to draw from the ground about four litres, or seven-eighths of a gallon of fluid every twenty-four hours. That at all events was the amount flowing from this open tap in its water system. Even the topmost branches of the tree had not become, during the fifteen days, abnormally flaccid, so that, presumably, no drainage of fluid from the upper portion of the tree had been taking place. For a fortnight, therefore, the tree apparently had been drawing, pumping, sucking—I know not what word to use—nearly a gallon of fluid daily from the soil in the neighbourhood of its roots. This soil had only an ordinary degree of dampness. It was not wet, still less was there any actually fluid water to be seen. Indeed, usually all the adjacent soil is of a dry kind, for we are on the plateau of a hill 265 feet above the sea, and the level of the local reservoir into which our wells dip is about 80 feet below the surface. My gardener tells me that the tree has been "bleeding" at about the same rate for fourteen of the fifteen days, the first day the branch becoming only somewhat damp. During the earlier part of that time we had frosts at night, and sunshine, but with extremely cold winds, during the days. At one time the exuding sap gave, I am told by two different observers, icicles a foot long. A much warmer, almost summer, temperature has prevailed during the past three days and no wind. This morning the temperature of the sap as it escaped was constant at 52° F., while that of the surrounding air was varying considerably.

The collected sap was a clear, bright, water-like fluid. After a pint had stood aside for twelve hours there was the merest trace of a sediment at the bottom of the vessel. The microscope showed this to consist of parenchymatous cells, with here and there a group of the wheel-like or radiating cells which botanists, I think, term sphere-crystals. The sap was slightly heavier than water, in the proportion of 1005 to 1000. It had a faintly sweet taste and a very slight aromatic odour.

Chemical analysis showed that this sap consisted of 99 parts of pure water with 1 part of dissolved solid matter. Eleven-twelfths of the latter was sugar.

That the birch readily yields its sap when the wood is wounded is well known. Phillips, quoted by Sowerby, says:—

> "Even afflictive birch
> Cursed by unlettered youth, distils
> A limpid current from her wounded bark,
> Profuse of nursing sap."

And that birch sap contains sugar is known, the peasants of many countries, especially Russia, being well acquainted with the art of making birch wine by fermenting its saccharine juice.

But I find no hourly or daily record of the amount of sugar-bearing sap which can be drawn from the birch, or of any sap from any tree, before it has acquired its great digesting or rather developing and transpiring apparatus—its leaf system. And I do not know of any extended chemical analysis of sap either of the birch or other tree.

Besides sugar, which occurs in this sap to the extent of 616 grains, nearly an ounce and a half per gallon, there are present a mere trace of mucilage: no starch; no tannin; 3½ grains per gallon of ammoniacal salts yielding 10 per cent. of nitrogen; 3 grains of albumenoid matter yielding 10 per cent. of nitrogen; a distinct trace of nitrites; 7·4 grains of nitrates containing 17 per cent. of nitrogen; no chlorides, or the merest trace; no sulphates; no sodium salts; a little of potassium salts: much phosphate and organic salts of calcium; and some similar magnesian compounds. These calcareous and magnesian substances yield an ash when the sap is evaporated to dryness and the sugar and other organic matter burnt away, the amount of this residual mineral matter being exactly 50 grains per gallon. The sap contained no peroxide of hydrogen. It was faintly if at all acid. It held in solution a ferment capable of converting starch into sugar. Exposed to the air it soon swarmed with bacteria, its sugar being changed to alcohol.

A teaspoonful or two of, say, apple juice, and a tablespoonful of sugar put into a gallon of such rather hard well-water as we have in our chalky district, would very fairly represent this specimen of the sap of the silver birch. Indeed, in the phraseology of a water-analyst, I may say that the sap itself has 25 degrees of total, permanent, hardness.

How long the tree would continue to yield such a flow of sap I cannot say. Probably until the store of sugar it manufactured last summer to feed its young buds this spring was exhausted. Even within twenty-four hours the sugar has slightly diminished in proportion in the fluid.

Whether or not this little note throws a single ray of light on the much debated question of the cause of the rise of sap in plants I must leave to botanists to decide. I cannot hope that it does, for Julius Sachs, than whom no one appears to have more carefully considered the subject, says, at page 677 of the recently published English translation of his text-book of botany, that "although the movements of water in plants have been copiously investigated and discussed for nearly two hundred years, it is nevertheless still impossible to give a satisfactory and deductive account of the mode of operation of these movements in detail." As a chemist and physicist myself, knowing something about capillary attraction, exosmose, endosmose, atmospheric pressure and gravitation generally, and the movements caused by chemical attraction, I am afraid I must concur in the opinion that we do not yet know the real ultimate cause or causes of the rise of sap in plants.—From the *Pharmaceutical Journal*.

An ingenious device for a *lantern* has been patented by Mr. David C. Baughman, of Albion, Ind. The invention consists in a false top forming an air space in the upper part of the lantern, from which the air is conducted to the lamp by downwardly projecting air tubes. The invention also consists in an exterior and an interior chimney in the upper part of the lantern, which chimneys are covered by a cowl provided with a side opening and a weather vane, whereby the air inlet and outlet can be covered and the wind prevented from passing through the opening of the cowl, by which device the air as it reaches the lamp flame is warm, and the brightness of the light increased.

Galvanising or coating fence or other wires with metal has been patented by Mr. Henry Cull, of Johnstown, Pa. The invention consists in two chambers connected by a pipe or tube, one of which is to be heated and supplied with metal for galvanising until the melted metal shall have flowed into and nearly filled the second receptacle, which must be kept hot also. The wire, after being properly treated with acid, is passed through a pipe arranged for the purpose, and up through the top over an apparatus for coiling, which gives the wire a steady and continuous motion through the metal. As the liquid metal in pipe and receptacle is being gradually taken up by the wire, more is gradually flowing in from the receiving pan, which must be supplied from time to time as it runs low. By this arrangement the addition of cold metal has so little effect upon the temperature of the metal at the point where it is applied to the wire, that the coating is at all times light, even, and smooth.

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